

IN THE CLAIMS:

The status of each claim that has been introduced in the above-referenced application is identified in the ensuing listing of the claims. This listing of the claims replaces all previously submitted claims listings.

1. (Previously presented) An apparatus for performing a specific binding assay, the apparatus comprising:  
a composite waveguide comprising:  
a substrate comprising a first optical material of refractive index  $n_1$  and having a first planar surface and an opposite second surface, and  
a waveguide film comprising a second optical material having a refractive index  $n_2$  which is greater than refractive index  $n_1$ , said waveguide film disposed on said first planar surface of said substrate;  
capture molecules, associated with said waveguide film, for interacting selectively with at least one type of selected analyte molecule;  
a light source operably disposed to direct a light beam into said composite waveguide for propagation by total internal reflection therein; and  
a light detection device positioned to collect light emitted from a surface of said waveguide film.
2. (Previously presented) The apparatus of claim 1, wherein said light detection device is positioned to detect light passing through said opposite second surface of said substrate of said composite waveguide.
3. (Original) The apparatus of claim 1, further comprising an optical coupling element.
4. (Original) The apparatus of claim 3, wherein said optical coupling element comprises at least one prism that focuses light into said waveguide film.

5. (Original) The apparatus of claim 3, wherein said optical coupling element comprises a diffraction grating that diffracts light into said waveguide film.
6. (Original) The apparatus of claim 5, wherein said diffraction grating is formed into said waveguide film at an upper surface thereof, opposite said first planar surface of said substrate.
7. (Original) The apparatus of claim 5, wherein said diffraction grating is formed into at least one of said first planar surface of said substrate and a surface of said waveguide film adjacent to said first planar surface.
8. (Original) The apparatus of claim 3, wherein said optical coupling element comprises a waveguide coupler that directs light into said waveguide film by evanescent coupling.
9. (Currently amended) The apparatus of claim 8, wherein said waveguide coupler further comprises an input waveguide and a ~~precise~~-spacing layer to evanescently couple light into said waveguide film across said ~~precise~~-spacing layer.
10. (Original) The apparatus of claim 9, wherein said waveguide coupler is disposed on an upper surface of said waveguide film, opposite said first planar surface of said substrate.
11. (Original) The apparatus of claim 9, wherein said input waveguide comprises an optical material having a refractive index  $n_3$  and a thickness of between about 0.5 mm and about 5 mm.
12. (Currently amended) The apparatus of claim 11, wherein said ~~precise~~-spacing layer comprises an optical material having a refractive index  $n_4$ , where  $n_4 < n_2$  and  $n_4 < n_3$ , said

~~precise~~-spacing layer having a thickness selected to optimize evanescent coupling of light from said input waveguide into said waveguide film.

13. (Original) The apparatus of claim 1, wherein said substrate has a thickness of at least about 10  $\mu\text{m}$ .

14. (Original) The apparatus of claim 1, wherein said waveguide film has a thickness of at least about 0.1  $\mu\text{m}$ .

15. (Original) The apparatus of claim 1, wherein said first optical material comprises at least one of silicon dioxide, quartz, fused silica, silicon oxynitride, and magnesium fluoride.

16. (Original) The apparatus of claim 1, wherein said second optical material comprises at least one of silicon oxynitride and silicon dioxide.

17. (Original) The apparatus of claim 1, wherein said light source comprises a laser.

18. (Previously presented) The apparatus of claim 1, wherein said light detection device comprises a charge-coupled device.

19. (Original) The apparatus of claim 1, wherein said composite waveguide further comprises a sample reservoir configured to contain a sample solution adjacent to a surface of said waveguide film.

20. (Previously presented) The apparatus of claim 19, wherein said sample reservoir contains a sample solution comprising a plurality of molecules of a selected analyte and a plurality of tracer molecules, said tracer molecules being activated by evanescent light escaping from said waveguide film into said sample solution.

21. (Original) The apparatus of claim 1, wherein said capture molecules are of a plurality of different types.

22. (Previously presented) The apparatus of claim 21, wherein said different types of said capture molecules are positioned at discrete locations from one another on a surface of said waveguide film.

23. (Original) The apparatus of claim 22, wherein said discrete locations are arranged in an array.

24. (Original) The apparatus of claim 21, wherein said different types of capture molecules are capable of reacting with at least two different analytes.

25. (Original) The apparatus of claim 21, wherein said different types of capture molecules are capable of reacting with at least four different analytes.

26-63 (Canceled)

64. (New) An apparatus for performing a specific binding assay, the apparatus comprising:

a composite waveguide comprising:

a substrate comprising a first optical material of refractive index  $n_1$  and having a first planar surface and an opposite second surface, and

a waveguide film comprising a second optical material having a refractive index  $n_2$  which is greater than refractive index  $n_1$ , said waveguide film disposed on said first planar surface of said substrate;

capture molecules, associated with said waveguide film, for interacting selectively with at least one type of selected analyte molecule;

a light source operably disposed to direct a light beam into said composite waveguide for

propagation by total internal reflection therein;  
an optical coupling element comprising a waveguide coupler:  
disposed on an upper surface of said waveguide film, opposite said first planar surface of said substrate,  
that directs light into said waveguide film by evanescent coupling, and  
that includes an input waveguide and a spacing layer to evanescently couple light into said waveguide film across said spacing layer, the input waveguide comprising an optical material having a refractive index  $n_3$  and a thickness of between about 0.5 mm and about 5 mm; and  
a light detection device positioned to collect light emitted from a surface of said waveguide film.

65. (New) The apparatus of claim 64, wherein said light detection device is positioned to detect light passing through said opposite second surface of said substrate of said composite waveguide.

66. (New) The apparatus of claim 64, wherein said optical coupling element comprises at least one prism that focuses light into said waveguide film.

67. (New) The apparatus of claim 64, wherein said optical coupling element comprises a diffraction grating that diffracts light into said waveguide film.

68. (New) The apparatus of claim 67, wherein said diffraction grating is formed into said waveguide film at an upper surface thereof, opposite said first planar surface of said substrate.

69. (New) The apparatus of claim 67, wherein said diffraction grating is formed into at least one of said first planar surface of said substrate and a surface of said waveguide film adjacent to said first planar surface.

70. (New) The apparatus of claim 64, wherein said spacing layer comprises an optical material having a refractive index  $n_4$ , where  $n_4 < n_2$  and  $n_4 < n_3$ , said spacing layer having a thickness selected to optimize evanescent coupling of light from said input waveguide into said waveguide film.

71. (New) The apparatus of claim 64, wherein said waveguide film has a thickness of at least about 0.1  $\mu\text{m}$ .

72. (New) The apparatus of claim 64, wherein said first optical material comprises at least one of silicon dioxide, quartz, fused silica, silicon oxynitride, and magnesium fluoride.

73. (New) The apparatus of claim 64, wherein said second optical material comprises at least one of silicon oxynitride and silicon dioxide.

74. (New) The apparatus of claim 64, wherein said light source comprises a laser.

75. (New) The apparatus of claim 64, wherein said light detection device comprises a charge-coupled device.

76. (New) The apparatus of claim 64, wherein said composite waveguide further comprises a sample reservoir configured to contain a sample solution adjacent to a surface of said waveguide film.

77. (New) The apparatus of claim 76, wherein said sample reservoir contains a sample solution comprising a plurality of molecules of a selected analyte and a plurality of tracer molecules, said tracer molecules being activated by evanescent light escaping from said waveguide film into said sample solution.

78. (New) The apparatus of claim 64, wherein said capture molecules are of a plurality of different types.

79. (New) The apparatus of claim 78, wherein said different types of said capture molecules are positioned at discrete locations from one another on a surface of said waveguide film.

80. (New) The apparatus of claim 79, wherein said discrete locations are arranged in an array.

81. (New) The apparatus of claim 78, wherein said different types of capture molecules are capable of reacting with at least two different analytes.

82. (New) The apparatus of claim 78, wherein said different types of capture molecules are capable of reacting with at least four different analytes.

83. (New) An apparatus for performing a specific binding assay, the apparatus comprising:

a composite waveguide comprising:

a substrate comprising a first optical material of refractive index  $n_1$  and having a first planar surface and an opposite second surface, and

a waveguide film comprising a second optical material having a refractive index  $n_2$  which is greater than refractive index  $n_1$ , said waveguide film disposed on said first planar surface of said substrate;

capture molecules, associated with said waveguide film, for interacting selectively with at least one type of selected analyte molecule;

a light source operably disposed to direct a light beam into said composite waveguide for propagation by total internal reflection therein; and

a light detection device positioned to collect light emitted from a surface of said waveguide film; and

a sample reservoir configured to contain a sample solution adjacent to a surface of said waveguide film.

84. (New) The apparatus of claim 83, wherein said light detection device is positioned to detect light passing through said opposite second surface of said substrate of said composite waveguide.

85. (New) The apparatus of claim 83, further comprising an optical coupling element.

86. (New) The apparatus of claim 85, wherein said optical coupling element comprises at least one prism that focuses light into said waveguide film.

87. (New) The apparatus of claim 85, wherein said optical coupling element comprises a diffraction grating that diffracts light into said waveguide film.

88. (New) The apparatus of claim 87, wherein said diffraction grating is formed into said waveguide film at an upper surface thereof, opposite said first planar surface of said substrate.

89. (New) The apparatus of claim 87, wherein said diffraction grating is formed into at least one of said first planar surface of said substrate and a surface of said waveguide film adjacent to said first planar surface.

90. (New) The apparatus of claim 85, wherein said optical coupling element comprises a waveguide coupler that directs light into said waveguide film by evanescent coupling.

91. (New) The apparatus of claim 90, wherein said waveguide coupler further comprises an input waveguide and a spacing layer to evanescently couple light into said waveguide film across said spacing layer.

92. (New) The apparatus of claim 91, wherein said waveguide coupler is disposed on an upper surface of said waveguide film, opposite said first planar surface of said substrate.

93. (New) The apparatus of claim 83, wherein said waveguide film has a thickness of at least about 0.1  $\mu\text{m}$ .

94. (New) The apparatus of claim 83, wherein said first optical material comprises at least one of silicon dioxide, quartz, fused silica, silicon oxynitride, and magnesium fluoride.

95. (New) The apparatus of claim 83, wherein said second optical material comprises at least one of silicon oxynitride and silicon dioxide.

96. (New) The apparatus of claim 83, wherein said light source comprises a laser.

97. (New) The apparatus of claim 83, wherein said light detection device comprises a charge-coupled device.

98. (New) The apparatus of claim 83, wherein said capture molecules are of a plurality of different types.

99. (New) The apparatus of claim 98, wherein said different types of said capture molecules are positioned at discrete locations from one another on a surface of said waveguide film.

100. (New) The apparatus of claim 99, wherein said discrete locations are arranged in an array.

101. (New) The apparatus of claim 98, wherein said different types of capture molecules are capable of reacting with at least two different analytes.

102. (New) The apparatus of claim 98, wherein said different types of capture molecules are capable of reacting with at least four different analytes.

103. (New) An apparatus for performing a specific binding assay, the apparatus comprising:

a composite waveguide comprising:

a substrate comprising a first optical material of refractive index  $n_1$  and having a first planar surface and an opposite second surface, and

a waveguide film comprising a second optical material having a refractive index  $n_2$  which is greater than refractive index  $n_1$ , said waveguide film disposed on said first planar surface of said substrate;

a plurality of different types of capture molecules associated with said waveguide film, each type of capture molecules configured to interact selectively with at least one type of selected analyte molecule, different types of capture molecules of said plurality positioned at discrete locations from one another and arranged in an array on a surface of said waveguide film;

a light source operably disposed to direct a light beam into said composite waveguide for propagation by total internal reflection therein; and

a light detection device positioned to collect light emitted from a surface of said waveguide film.

104. (New) The apparatus of claim 103, wherein said light detection device is positioned to detect light passing through said opposite second surface of said substrate of said composite waveguide.

105. (New) The apparatus of claim 103, further comprising an optical coupling element.

106. (New) The apparatus of claim 105, wherein said optical coupling element comprises at least one prism that focuses light into said waveguide film.

107. (New) The apparatus of claim 105, wherein said optical coupling element comprises a diffraction grating that diffracts light into said waveguide film.

108. (New) The apparatus of claim 107, wherein said diffraction grating is formed into said waveguide film at an upper surface thereof, opposite said first planar surface of said substrate.

109. (New) The apparatus of claim 107, wherein said diffraction grating is formed into at least one of said first planar surface of said substrate and a surface of said waveguide film adjacent to said first planar surface.

110. (New) The apparatus of claim 105, wherein said optical coupling element comprises a waveguide coupler that directs light into said waveguide film by evanescent coupling.

111. (New) The apparatus of claim 110, wherein said waveguide coupler further comprises an input waveguide and a spacing layer to evanescently couple light into said waveguide film across said spacing layer.

112. (New) The apparatus of claim 111, wherein said waveguide coupler is disposed on an upper surface of said waveguide film, opposite said first planar surface of said substrate.

113. (New) The apparatus of claim 103, wherein said waveguide film has a thickness of at least about 0.1  $\mu\text{m}$ .

114. (New) The apparatus of claim 103, wherein said first optical material comprises at least one of silicon dioxide, quartz, fused silica, silicon oxynitride, and magnesium fluoride.

115. (New) The apparatus of claim 103, wherein said second optical material comprises at least one of silicon oxynitride and silicon dioxide.

116. (New) The apparatus of claim 103, wherein said light source comprises a laser.

117. (New) The apparatus of claim 103, wherein said light detection device comprises a charge-coupled device.